

WEATHER, FORECASTS, AND WARNINGS.

By H. C. FRANKENFIELD, Professor of Meteorology.

At the beginning of the month pressure was high over Europe, the Atlantic Ocean, Alaska, and the north Pacific Ocean, and nearly normal over the United States and Canada, except the northeastern districts, which were covered by a marked depression that had moved eastward over Canada and the northern portion of the United States. General rains had fallen in the United States and temperatures were moderately low from the lake region eastward. There was also a moderate depression over northern Wyoming, but the extensive high area over the Atlantic Ocean and Europe effectually retarded its normal eastward movement, and it did not reach the lower lake region until the morning of June 5, by which time a well-marked high area from the Hudson Bay region had moved to the northeast coast. The disturbance was attended by general showers, and there were also occasional thunder-showers in the Ohio Valley and the South. Pressure began to fall over the Atlantic Ocean and Europe on June 6, but it continued high over New England and the Canadian maritime provinces, so that the low area to the westward was unable to escape. It finally merged into another irregular depression that had moved down from the British northwest since the morning of June 4. The results were generally unsettled and showery conditions on June 6 over the great central valleys and the upper lake region; on June 6 and 7 over the lower lake region, and from June 6 to 8, inclusive, in the Atlantic States. On Sunday, June 4, the following bulletin was issued:

High pressure prevails over the Northern Hemisphere, except over the Pacific Ocean, Alaska, and a limited area in the northwestern portion of the United States. The crest of the high pressure overlies the Azores, and this distribution indicates that the coming week will be generally fair over the country after thundershowers Sunday and Monday over the northern districts. Conditions are favorable, however, for local day showers during the week in Florida. There is no immediate prospect of materially cooler weather, and temperatures will probably continue high in the South and in the Central West, and will have a rising tendency in the East after Monday.

This forecast was not well verified as to weather owing to the retardation of the low area mentioned above, but the high temperatures occurred as indicated. As the low areas were keeping well to the northward, high temperatures to the southward were certain to occur, and, as a third low area from the Northwest was moving across the northern portion of the country, their persistence was equally certain, and the result was a warm wave that for duration and severity has rarely been equalled so early in the summer. This warm wave set in on June 2 over the Plains States, the Missouri Valley, the South and Southwest, and extended into the Mississippi and Ohio Valleys on the following day. There was a brief intermission on June 5 and 6 over the northern districts, caused by showers, with rising pressure, but it was not until June 9 in the Northern Plains States, June 10 in the upper Mississippi Valley, and June 11 in the western upper lake region that there was a general and decided reaction to lower temperatures in advance of a high-pressure area from the north Pacific coast. This high area spread southeastward over the Rocky Mountain region and the Plains States, with a crest of 30.34 inches over southeastern

Montana on the morning of June 11. High temperature continued in the South and Southwest, however. In the meantime the third low area before mentioned had moved slowly eastward attended by general showers and severe thunderstorms over the northern half of the country, reaching the Middle Atlantic States and New England on June 10 and continuing, with brief intermissions, in the East until June 18, effectually terminating the drought that had prevailed for several months. The rains in the East were preceded by abnormally high temperatures that attained their maximum on June 11. The unusual duration of the shower period was due to the persistence of the low area over New England and the Canadian maritime provinces, and to the approach of another from the West.

During the period from June 1 to 11, inclusive, pressure had been low over Alaska and nearly normal over Asia and the Pacific Ocean. It continued high over Iceland, but fell steadily over the remainder of Europe and over the Atlantic Ocean after June 6, about which time, it will be remembered, the northeastern Canadian high area attained its maximum strength.

Conditions had been more or less unsettled west of the Rocky Mountains, with frequent local showers and thunderstorms over the interior districts, but without occurrences of special importance. There was a cool wave over the northern plateau during June 4 and 5, and on the morning of the latter date the temperature reached the freezing point at the station in the Yellowstone Park, Wyoming. Over the southern plateau temperatures continued to rise steadily, and on June 11 the thermometer at Yuma, Ariz., reached 110 degrees for the first time during the present year.

On Tuesday, June 13, a disturbance appeared over eastern Colorado. It remained nearly stationary for 48 hours, attended by thunderstorms in the central Rocky Mountain region and the extreme Northwest, and then moved slowly eastward with increasing intensity, attended by general showers in the Plains States on June 15, in the great central valleys, and the central and southern upper Lake region on June 16 and 17, the western lower Lake region on June 17, and continuing until June 19 in the Ohio Valley. After reaching the Ohio Valley on June 17, the low area began to decrease in intensity, and contracted into a limited area over the lower Mississippi Valley, while a slight secondary disturbance had appeared over North Carolina. A general thunderstorm period then set in over the Southern States and it did not end until June 26. Local showers also continued in the central Rocky Mountain region until June 18, by which time there had been a material rise in pressure over the interior of the country.

During this period of unsettled weather high temperatures had continued in the central Plains States, the Southwest and the South, and on June 16 and 17 extended into the middle Mississippi and Ohio Valleys. In western Arkansas, Oklahoma, western Louisiana, and interior Texas the maximum temperatures for several days ranged from 100 to 106 degrees, and the month closed without material relief in the Southwest. Temperatures

were also high in the Northwest, but not abnormally so, while in the East they were moderately cool.

West of the Rocky Mountains the weather had been fair with the exception of occasional local thunderstorms in the middle plateau. Temperatures were comparatively low on June 13 and 14, and moderately high during the remainder of the time from June 12 to 19, inclusive, except on the coast, where they were slightly below the seasonal average as a rule.

From June 11 to 19, inclusive, pressure was high over the northeastern Pacific Ocean, and by June 15 the high area had extended to northwestern Alaska, reaching its crest on June 19. Relatively low pressure prevailed over the north Atlantic Ocean, and high pressure over western Europe until June 17, when the conditions reversed and marked low pressure covered the British Isles from June 17 to 26, inclusive. Over eastern Europe and Asia pressure was variable within reasonable limits, except on the Pacific coast, which was covered by a well-marked low area from June 17 to 21, inclusive.

The week ending with Monday, June 26, was characterized by high temperatures in the Plains States, the Missouri and upper Mississippi Valleys and the western upper Lake region, and by persistent and heavy thunder-showers in the South, except in Texas, where the showers were local and much lighter. In portions of northwestern Missouri, Kansas, and Oklahoma the temperature records for the month of June were either equaled or exceeded, and on Sunday, June 25, the maximum temperature at Wichita and Dodge City, Kans., was 108 degrees, 4 degrees higher than the previous high record.

Pressure was generally low over New England and the Canadian maritime provinces until June 24, when a high area from the British Northwest reached the coast and merged with another that had formed over the Atlantic Ocean. Pressure was also high on the Pacific coast, but several irregular low areas from the interior moved slowly eastward over the country attended by the warm wave before mentioned, and on June 22 and 23 the high temperatures reached the Atlantic coast States except New England. Local showers were quite frequent over the northern districts west of the Rocky Mountains and along the slopes of the mountains, and also in the Dakotas and Montana after June 20. There were no showers in the central valleys and the Lake region until June 23, from which date until June 27 they were frequent. Local showers also occurred daily in New England, and, after June 22, in the Middle Atlantic States. On June 24 the high area on the Pacific coast began to move eastward with some increase in intensity, and accompanied by falling temperature that became quite marked over the Northwestern States by the morning of June 27, and light frost occurred at Devils Lake, N. Dak., on that date.

During this week pressure was low over western Europe with unsettled weather, and comparatively high over eastern Europe and western Asia. Over eastern Asia and the western Pacific Ocean low pressure ruled, while over the eastern Pacific it was relatively high. Over Alaska there was a slow and steady fall from the high point of June 19.

From June 27 to 30, inclusive, the northwestern high-pressure area moved eastward over the upper Mississippi Valley and the Lake region, and at the end of the month it was central over the lower Lake region. This high area brought with it more moderate temperatures, and marked the termination of the shower period over the territory east of the Mississippi River, except in the South, where local day thunderstorms continued. The final shower at Washington, D. C., on the afternoon of

June 27 followed a day of high temperature, and the rain was accompanied by high winds and hail that did considerable damage. During the storm the dairy building at the National Soldiers' Home was struck by lightning, and the building was entirely destroyed by fire, causing a loss of \$50,000.

The temperature fall over the Lake region and the Middle Atlantic States was pronounced; frost was reported on the morning of June 28 in portions of Wisconsin, and frost warnings were ordered on June 27 for the cranberry marshes of that State. Snow flurries were also reported at Sault Ste. Marie, Mich., on the morning of June 28.

During the eastward progress of this last high area of the month pressure fell steadily and decidedly throughout the West. The general trend of the depression was northeastward from the Middle Plateau, with a recovery by the end of the month, when what remained of the low area was central over the Dakotas. Local showers and thunderstorms were of frequent occurrence to the westward and northward of the low area, and they continued at the end of the month. There were also showers during the night of June 27-28 in Kansas, and during June 29 in Arizona. To the eastward and southeastward of the path of low pressure another warm wave set in, reaching the central Rocky Mountain region and the Plains States on June 28, continuing at the end of the month and extending into the central valleys and the upper Lake region. On June 29 the temperature records for the month of June were equaled or exceeded in portions of Nebraska and South Dakota, with thermometer readings from 100° to 104°.

There was not enough rain during the month between the Mississippi River and the Rocky Mountains to be of material benefit, and at the end of the month the drought was still unbroken without immediate prospect of rain, and with every prospect of more intensely hot weather that would soon extend over the states east of the Mississippi River.

During the closing days of the month there was a reaction to higher pressure over western Europe, and high pressure continued over eastern Europe and western Asia. Over eastern Asia pressure also rose except on the coast.

There were no storms along the ocean and Gulf coasts of the United States, and none on the Great Lakes, and no storm warnings were ordered during the month.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since Jan. 1.	Average departures since Jan. 1.
New England.....	12	82.9	- 0.7	+ 1.2	+ 0.2
Middle Atlantic.....	15	70.4	+ 0.3	+ 5.2	+ 0.9
South Atlantic.....	10	79.0	+ 2.9	+ 11.9	+ 2.0
Florida Peninsula*.....	7	81.0	+ 1.2	+ 11.8	+ 2.0
East Gulf.....	11	81.0	+ 2.9	+ 20.6	+ 3.4
West Gulf.....	10	82.8	+ 4.0	+ 22.7	+ 3.8
Ohio Valley and Tennessee.....	13	75.3	+ 2.0	+ 16.5	+ 2.8
Lower Lakes.....	10	67.1	+ 0.3	+ 11.2	+ 1.9
Upper Lakes.....	12	65.2	+ 3.1	+ 20.4	+ 3.4
North Dakota*.....	9	66.6	+ 3.8	+ 8.2	+ 1.4
Upper Mississippi Valley.....	14	75.8	+ 4.9	+ 23.2	+ 3.9
Missouri Valley.....	12	77.7	+ 6.8	+ 27.6	+ 4.6
Northern slope.....	9	65.0	+ 2.8	+ 9.4	+ 1.6
Middle slope.....	8	77.8	+ 6.0	+ 23.8	+ 4.0
Southern slope*.....	8	82.4	+ 5.7	+ 23.7	+ 4.0
Southern Plateau*.....	10	73.7	- 1.6	+ 2.5	+ 0.9
Middle Plateau*.....	10	64.4	+ 0.4	+ 5.5	+ 0.4
Northern Plateau*.....	11	62.8	+ 0.5	- 2.9	- 0.4
North Pacific.....	7	54.9	- 2.7	- 9.9	- 1.6
Middle Pacific.....	5	61.9	- 2.3	- 7.7	- 1.3
South Pacific.....	4	65.2	- 0.9	- 0.4	- 0.1

* Regular Weather Bureau and selected cooperative stations.

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
New England.....	11	2.68	87	- 4.0	- 4.7
Middle Atlantic.....	15	3.74	100	0.0	- 6.2
South Atlantic.....	11	3.31	67	- 1.6	- 12.3
Florida Peninsula*.....	7	4.05	59	- 2.8	- 8.9
East Gulf.....	11	3.25	71	- 1.3	- 5.6
West Gulf.....	10	1.11	30	- 2.6	- 6.2
Ohio Valley and Tennessee.....	13	3.22	78	- 0.9	- 3.2
Lower Lakes.....	10	3.53	100	0.0	- 1.5
Upper Lakes.....	12	3.01	97	- 0.1	- 0.8
North Dakota*.....	9	2.84	80	- 0.7	- 0.2
Upper Mississippi Valley.....	15	2.95	68	- 1.4	- 4.2
Missouri Valley.....	12	1.04	24	- 3.3	- 5.7
Northern slope.....	9	2.27	100	0.0	- 1.8
Middle slope.....	6	0.46	15	- 2.7	- 4.7
Southern slope*.....	8	0.58	12	- 2.9	- 4.2
Southern Plateau*.....	10	0.51	165	+ 0.2	+ 0.9
Middle Plateau*.....	11	0.80	160	+ 0.3	+ 0.2
Northern Plateau*.....	11	1.93	145	+ 0.6	- 1.5
North Pacific.....	7	0.92	46	- 1.1	+ 7.8
Middle Pacific.....	7	0.09	31	- 0.2	+ 3.5
South Pacific.....	4	0.01	100	0.0	+ 7.4

* Regular Weather Bureau and selected cooperative stations.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure.	Districts.	Average.	Departure.
New England.....	76	- 3	Missouri Valley.....	54	- 13
Middle Atlantic.....	73	0	Northern slope.....	62	+ 5
South Atlantic.....	72	- 6	Middle slope.....	46	- 14
Florida Peninsula.....	78	- 1	Southern slope.....	49	- 11
East Gulf.....	70	- 5	Southern Plateau.....	36	+ 3
West Gulf.....	62	- 14	Middle Plateau.....	44	+ 7
Ohio Valley and Tennessee.....	66	- 4	Northern Plateau.....	52	+ 1
Lower Lakes.....	72	+ 1	North Pacific.....	75	- 2
Upper Lakes.....	75	+ 2	Middle Pacific.....	56	- 6
North Dakota.....	70	+ 2	South Pacific.....	68	+ 2
Upper Mississippi Valley.....	63	- 7			

Average cloudiness and departures from the normal.

Districts.	Average.	Departure.	Districts.	Average.	Departure.
New England.....	6.1	+0.9	Missouri Valley.....	3.7	-1.2
Middle Atlantic.....	5.3	+0.3	Northern slope.....	4.8	0.0
South Atlantic.....	4.8	-0.2	Middle slope.....	3.5	-0.5
Florida Peninsula.....	4.7	-0.5	Southern slope.....	3.3	-0.5
East Gulf.....	4.9	+0.2	Southern Plateau.....	3.0	+1.0
West Gulf.....	2.9	-1.4	Middle Plateau.....	4.2	+0.9
Ohio Valley and Tennessee.....	5.0	0.0	Northern Plateau.....	5.1	+0.5
Lower Lakes.....	5.3	+0.4	North Pacific.....	6.1	0.0
Upper Lakes.....	5.4	+0.3	Middle Pacific.....	4.2	+0.9
North Dakota.....	5.2	-0.2	South Pacific.....	3.9	+0.6
Upper Mississippi Valley.....	4.6	-0.4			

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Bismarck, N. Dak..	9	58	n.	New York, N. Y....	16	72	n.
Chattanooga, Tenn..	24	51	sw.	Do.....	20	52	n.
Detroit, Mich.....	4	59	n.	Pensacola, Fla.....	3	50	e.
El Paso, Tex.....	27	53	se.	Pittsburg, Pa.....	4	58	nw.
Lincoln, Nebr.....	25	50	se.	Do.....	11	50	w.
Do.....	26	56	w.	Do.....	26	50	nw.
Minneapolis, Minn..	24	50	sw.	Point Reyes Light, Cal.....	12	58	nw.
Modena, Utah.....	23	50	sw.	Do.....	13	59	nw.
Do.....	23	58	sw.	Do.....	21	51	nw.
Mount Tamalpais, Cal.....	25	55	nw.	Do.....	23	53	nw.
Do.....	26	62	nw.	Do.....	27	70	nw.
Do.....	27	64	nw.	Do.....	28	76	nw.
Do.....	28	78	nw.	Do.....	29	79	nw.
New York, N. Y....	10	70	ne.	St. Paul, Minn.....	3	50	nw.
Do.....	11	51	nw.	Southeast Farallon, Cal.....	29	54	nw.
Do.....	15	67	nw.				